MATH 310 SOLUTIONS TO HW 1

1 a)

S	T	$S \wedge T$	$S \vee T$	$\sim(S \vee T)$	$(S \wedge T) \vee \sim(S \vee T)$
T	T	T	T	F	T
T	F	F	T	F	F
F	T	F	T	F	F
F	F	F	F	T	T

c)

S	T	$\sim S$	$\sim T$	$\sim S \vee T$	$S \wedge \sim T$	$\sim(S \wedge \sim T)$	$(\sim S \vee T) \Leftrightarrow \sim(S \wedge \sim T)$
T	T	F	F	T	F	T	T
T	F	F	T	F	T	F	T
F	T	T	F	T	F	T	T
F	F	T	T	T	F	T	T

g)

S	T	$\sim S$	$T \vee \sim S$	$S \wedge (T \vee \sim S)$
T	T	F	T	T
T	F	F	T	T
F	T	T	T	F
F	F	T	T	F

2 b) $U \Rightarrow (V \vee \sim S)$

d) $S \Rightarrow V$

f) $S \Rightarrow \sim T$

4, b) If there are clouds then it will rain

CONVERSE: If it will rain, then it is cloudy.

CONTRAPOSITIVE: If it is not raining, then there are no clouds.

d) CONVERSE: If means eat oats, then I am not a fool.

CONTRAPOSITIVE: If means do not eat oats, then I am a fool.

f) If all people disarm then there will be peace in the world.

CONVERSE: If there is peace in the world, then all people will disarm.

CONTRAPOSITIVE: If there is no peace in the world, then some people will not disarm.

5 b) TRUE because both $2+2=4$ and $3/5$ is rational.

d) $2 \cdot 3 \neq 5$ so hypothesis false.
The world is not flat so conclusion is false.
Hence implication is true.

f) $3^2 = 9$ so hypothesis is false.
$4^2 \neq 17$ so conclusion is false.
Hence implication is true.

6. b) $\sim(S \vee T)$

d) $\sim(\sim S \vee \sim(T \vee \sim S))$

10 b) There exists a first variable so that, for all second variables, if the second variable exceeds the first variable, then the second variable is greater than 5.

d) There is a variable which is positive and whose square exceeds its cube.

f) There is a variable so that it is not true that if the square of the variable is positive then the variable is positive.

14. b) $\sim A \Rightarrow \sim B$ is logically equivalent to $A \vee \sim B$. This is not logically equivalent to $A \wedge \sim B$.

d)

A	B	$\sim A$	$B \Rightarrow \sim A$	$A \vee B$	$A \Rightarrow (A \vee B)$
T	T	F	F	T	T
T	F	F	T	T	T
F	T	T	T	T	T
F	F	T	T	F	T

not the same so logically inequivalent

f) $\sim(A \vee \sim B)$ is logically equivalent to $\sim A \wedge B$

22. $\forall x, P(x)$ says that $P(x)$ is true for every value of x.

$\sim \exists x, \sim P(x)$ says that it is not true that there exists an x for which $P(x)$ fails.

These say the same thing.